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(21)Application number : **10-362430** (71)Applicant : **TAIYO KAGAKU CO LTD**

(22)Date of filing : **21.12.1998** (72)Inventor : **NAKADA KATSUYASU
NANBU HIRONOBU**

(54) MAGNESIUM-ENRICHED FOOD**(57)Abstract:**

PROBLEM TO BE SOLVED: To obtain a magnesium-enriched food free from bitter taste and having good thermal stability and dispersibility by including magnesium phosphate, an enzyme-decomposed lecithin, a polyglycerol fatty acid ester and a thickening polysaccharide (or its decomposition product).

SOLUTION: A magnesium composition is produced by compounding a magnesium phosphate such as trimagnesium phosphate and/or magnesium hydrogen phosphate, an enzyme-decomposed lecithin produced by using phospholipase A such as lysophosphatidylcholine, lysophosphatidylethanolamine and lysophosphatidylinositol, a polyglycerol fatty acid ester such as an ester of a polyglycerol containing $\geq 70\%$ fraction having a polymerization degree of ≥ 3 with a 6-22C fatty acid and a thickening polysaccharide (or its decomposition product) such as gum arabic, pectin and carrageenan. A slurry containing the above composition is added with reconstituted skim milk, butter, etc., homogenized with a homomixer and a homogenizer and sterilized to obtain the objective Mg-enriched food.

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CLAIMS

[Claim(s)]

[Claim 1] Magnesium fortified food containing the magnesium constituent containing magnesium phosphate, zymolysis lecithin, polyglyceryl fatty acid ester and thickening polysaccharide, or those decomposition products.

[Claim 2] Magnesium fortified food according to claim 1 characterized by magnesium phosphate being phosphoric-acid 3 magnesium and/or phosphoric-acid hydrogen magnesium.

[Claim 3] Magnesium fortified food given in claim 1 characterized by being one sort chosen from the group which zymolysis lecithin becomes from the phosphatidic acid generated using a lysophosphatidylcholine [which is generated using phospholipase A], lysophosphatidylethanolamine, and RIZOHOSUFACHIIRUINO C torr, the lysophosphatidylserine, and phospholipase D, lysophosphatidic acid, phosphatidylglycerol, and RIZOHOSUFA tidylglycerol, or two sorts or more – 2 any 1 terms.

[Claim 4] Magnesium fortified food given in claim 1 to which polyglyceryl fatty acid ester is characterized by being the saturation of the polyglycerin and the carbon numbers 6–22 in which the polymerization degree of polyglycerin contains three or more fractions 70% or more, or ester of unsaturated fatty acid – 3 any 1 terms.

[Claim 5] Magnesium fortified food given in claim 1 characterized by being one sort or two sorts or more of mixture with which thickening polysaccharide is selected from gum arabic, pectin, carrageenan, a furcellaran, guar gum, locust bean gum and xanthan gum, or those decomposition products – 4 any 1 terms.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is an object about a magnesium constituent strengthening eating-and-drinking article, and relates to the magnesium fortified food which contains the magnesium constituent containing magnesium phosphate, zymolysis lecithin, polyglyceryl fatty acid ester, and thickening polysaccharide in more detail.

[0002]

[Description of the Prior Art] 20-30g are held by in the living body by the adult, magnesium exists in all presentations except a fat, and 50% or more exists in the bone. Moreover, for a living body, bony formation, the activation of biochemical catalytic reaction, transfer of a nerve stimulus, etc. share calcium and an antagonism-function, and magnesium is an important mineral physiologically. Moreover, bringing about circulatory organ failures, such as mental disorder, such as cardiovascular functional disorders, such as ischemic heart disease, a delusion, insecurity, an agitation, and distraction, arrhythmia, extrasystole, tachycardia, and ventricular fibrillation, by lack of magnesium is admitted. However, in spite of specifying the intake situation of the magnesium in Japan as target requirements of 300mg/day in "the fifth amendment Japanese's recommended dietary allowance", according to various investigations, it is reported that average intake is about 250mg/day, and is in an insufficient inclination. Although water-soluble magnesium salt, such as a magnesium chloride and magnesium sulfate, is widely used for food in order to compensate lack of such magnesium, as for the addition to food, a limit will be received for the bitterness resulting from the isolation to aqueous phase, such as magnesium ion. Although the approach (JP,2-56416,A) of adding sweeteners and a perfume agent in order to mask bitterness for this problem solving, the approach (JP,3-236316,A) of adding cyclodextrin, etc. have been performed, sufficient reduction effectiveness of bitterness is not acquired. Moreover, by the bitterness reduction approach (JP,8-332053,A) by water-in-oil type

emulsification of a magnesium salt water solution, since a continuous phase is an oil, it cannot use for drainage system food.

[0003]

[Problem(s) to be Solved by the Invention] After food processing, such as heating, has little this invention, and bitterness offers a technical problem magnesium fortified food excellent in distributed stability. Hereafter, this invention is explained in detail.

[0004]

[Means for Solving the Problem] this invention persons came to complete header this invention for a header and the magnesium fortified food which adds this constituent further and is obtained solving the above-mentioned technical problem for bitterness having few magnesium constituents containing magnesium phosphate, zymolysis lecithin, polyglyceryl fatty acid ester, and thickening polysaccharide also even as for after heating, and distributed stability being good, as a result of inquiring wholeheartedly that the above-mentioned technical problem should be solved.

[0005]

[Embodiment of the Invention] The magnesium phosphate in this invention is phosphoric-acid 3 magnesium and/or phosphoric-acid hydrogen magnesium, and its phosphoric-acid 3 magnesium with less bitterness to which underwater solubility originates in the isolation to the aqueous phase of magnesium ion lower among these is desirable.

[0006] Although it is desirable for the mean particle diameter to be a particle 2 micrometers or less and it does not limit especially the process in order for the magnesium phosphate of high specific gravity to distribute to stability, although especially the particle diameter of magnesium phosphate is not limited, either, compared with the physical crushing method which needs expensive very special and equipment, the easy cheap and neutralization salt formation method of particle diameter adjustment is desirable. The thing using neutralization according like tricalcium phosphate as a neutralization salt formation method to the weak acid-strong basic salt of a phosphoric acid (H_3PO_4) and a calcium hydroxide ($\text{Ca}(\text{OH})_2$), Or the thing using neutralization by the weak acid-weak basic salt of magnesium acetate (CH_3COO) (2Mg) and ammonium phosphate (NH_4) (2HPO_4) is known like phosphoric-acid hydrogen magnesium, and a 0.01-0.1-micrometer ultrafine particle is generated as a primary particle. Although use of frost shattering using dry type crushers, such as wet mills, such as KOBORUMIRU, and a jet mill, or liquid nitrogen etc. is mentioned about the physical crushing approach, it does not interfere, even if it will use any, if it is the thing of the engine performance which can perform ultrafine particle-ization with a mean particle diameter of 2 micrometers or less.

[0007] The zymolysis lecithin in this invention is one sort chosen from the group which consists of a lysophosphatidylcholine [which is obtained / part /

fatty-acid-ester / by phospholipase A by hydrolyzing restrictively in vegetable lecithin or yolk lecithin], lysophosphatidylethanolamine, and RIZOHOSUFACHIJIRUINO C torr and the mono-acyl glycerophospholipid centering on the lysophosphatidylserine, the phosphatidic acid that uses phospholipase D for a list and is generated, lysophosphatidic acid, phosphatidylglycerol, and RIZOHOSUFA tidylglycerol, or two sorts or more. It is lysophosphatidylcholine, lysophosphatidylethanolamine, and the lysophosphatidylserine and is lysophosphatidylcholine more preferably. The phospholipase used for zymolysis does not ask the origin of the microorganism origins, such as the vegetable origins, such as the animal origins, such as the pig pancreas, and a cabbage, or mold, etc., but should just have phospholipase A and/or D activity.

[0008] Moreover, although especially the polyglyceryl fatty acid ester in this invention is not limited, the polymerization degree of a glycerol is two or more, and in case the polyglyceryl fatty acid ester which makes a hydrophilic group the polyglycerin of polymerization degree 3-10 and the polyglycerin whose polyglycerin content of polymerization degree 3-5 is 70% or more is used, very suitable dispersibility is acquired still more preferably preferably. The configuration fatty acids of polyglyceryl fatty acid ester are carbon numbers 6-22, and the thing of 8-18, and also good better ** 12-14 is used preferably.

[0009] Furthermore, although especially the thickening polysaccharide in this invention is not limited, by using together one sort or two sorts or more of thickening polysaccharide preferably selected from gum arabic, pectin, a carrageenan, a furcellaran, guar gum, locust bean gum and xanthan gum, or those decomposition products, it does not have condensation of magnesium phosphate and can raise distributed stability further. Moreover, effectiveness with the same said of using together hydrophilic synthetic macromolecules, such as polysaccharide or polyvinyl alcohol, such as crystalline cellulose, and a vinyl acetate copolymer, is acquired.

[0010] The magnesium constituent of this invention has the description at the preparation process like a constituent. If processing of zymolysis lecithin is not probably performed to a magnesium phosphate particle before addition of polyglyceryl fatty acid ester and thickening polysaccharide, or those decomposition products, it does not come to obtain the magnesium constituent which has the good dispersibility which controlled secondary condensation. That is, neutralization salt formation of magnesium-hydroxide suspension and the phosphoric-acid water solution is carried out under zymolysis lecithin existence, or after [a certain] being and carrying out neutralization salt formation of magnesium-hydroxide suspension and the phosphoric-acid water solution, zymolysis lecithin is added, and zymolysis lecithin is beforehand processed to a magnesium phosphate particle. Polyglyceryl fatty acid ester and thickening polysaccharide are added after an appropriate time, and it is obtained by centrifugal separation, membrane separation, etc. performing solid

liquid separation, and collecting the solid phase sections. The addition sequence and the addition stage of polyglyceryl fatty acid ester or thickening polysaccharide will not be especially limited, if it is after processing of zymolysis lecithin is carried out by the magnesium phosphate particle.

[0011] Especially the magnesium fortified food containing the magnesium constituent of this invention does not limit the class, and all processed foods are applicable. If a processed food is illustrated, emulsification food, starch content food, saccharide content food, protein content food, etc. will be raised. the food which the oleophilic component or the hydrophilic component is emulsifying or distributing to the water layer with emulsification food here -- it is -- as dairy products, such as a milk beverage, fermented milk, ice cream, a coffee whitener, whipped cream, and a cheese head, or low pH food -- as mayonnaise, a dressing, acid whipped cream, and high salt concentration food -- the source -- hanging down -- etc. -- drinks, such as an emulsification seasoning and a coffee drink, and an alcoholic beverage, the emulsification perfume which emulsified or solubilized oily perfume further are said. Starch content food is food using the starch of the grain origin, such as rice, wheat, and a potato, and the food containing starch, such as baked confectionery and soup, such as a biscuit besides being cooking rice, noodles, paste, a pan, a cake, etc., Cookie, and a cracker, Calais, a stew, a pouch-packed food, and mashed potatoes, is said.

[0012] Saccharide content food means confectionery, such as a candy, chewing gum, making tablet confectionery, and cocoa, a soft drink, jelly, ice cream, etc. with the food containing polysaccharide, such as monosaccharides, such as sugar, grape sugar, and fruit sugar, a lactose, an oligosaccharide, and a dextrin. Protein content food is the food which contains vegetable albumin, such as wheat and an soybean, the protein of an egg, etc. in animal protein pans, such as lactalbumins, such as cow's milk, and a fish, meat, and a hum, a sausage, tofu, an egg processed food, etc. are said.

[0013] Especially about the process of the magnesium fortified food containing the magnesium constituent of this invention, it cannot limit and can manufacture using the machine and instrument which are used for the usual food manufacturing, processing, and cooking. Although especially the amount of magnesium in the magnesium fortified food containing the magnesium constituent of this invention is not limited, it is 0.001 % of the weight - 20 % of the weight in the food which corresponds from the intake initial complement of magnesium. When there are few amounts of magnesium than 0.001 % of the weight, the addition effectiveness of magnesium is not acquired. Moreover, if [than 20 % of the weight] more, it will become difficult to hold the gestalt of food. Furthermore, it is 0.01 % of the weight - 10 % of the weight preferably.

[0014]

[Example] Although an example, the example of reference, and the example of a trial are given to below next and this invention is explained in more detail,

this invention is not restrained at all by these examples etc. In addition, especially “%” in an example means “% of the weight”, unless it explains. Preparation of an example 1 magnesium constituent: Dissolve 2.7kg of phosphoric acids, and zymolysis lecithin (SANRESHICHINL; TAIYO KAGAKU CO., LTD. make) 0.2kg in 100kg of ion exchange water 85%, prepare a zymolysis lecithin content phosphoric-acid solution, independently, after distributing 2.0kg of magnesium hydroxides to 300kg of ion exchange water, into the solution which added 2.0kg (SunSoft A-14C; TAIYO KAGAKU CO., LTD. make) of polyglyceryl fatty acid ester, and dissolved, add gradually under stirring and adjust pH of mixed liquor 5.0. After the salt formation reaction of the magnesium phosphate by neutralization was completed, gum arabic (neo software AB; TAIYO KAGAKU CO., LTD. make) 0.8kg was dissolved, according to centrifugal separation (for 3000xg and 10 minutes), solid liquid separation was performed, 4.0kg (dry weight conversion) of magnesium phosphate of the solid phase section was collected, it re-suspended in ion exchange water, and the magnesium phosphate slurry (magnesium concentration; 2.78%) was prepared 10%. Mean particle diameter was about 0.07 micrometers from measurement by the laser diffraction particle-size-distribution measuring device (product made from model 370:NICOMP).

[0015] Ion exchange water was added to 463g (food additive; Wako Pure Chem, Inc.) of example of comparison 1 magnesium-chloride 6 hydrates, and it was referred to as 2.0kg, and the stirring dissolution was carried out and the magnesium chloride water solution (magnesium concentration; 2.78%) was prepared.

Ion exchange water was added to 562g (food additive; Wako Pure Chem, Inc.) of example disulfuric acid magnesium of comparison 7 hydrates, and it was referred to as 2.0kg, and the stirring dissolution was carried out and the magnesium sulfate mixture solution (magnesium concentration; 2.78%) was prepared.

[0016] Butter 400g and 10% magnesium phosphate slurry 200g of an example 1 were added to 9.4kg of example reduction skimmilks of manufacture of example 2. magnesium fortified milk, and stirring was performed for 9000rpm and 20 minutes in TK homomixer. Subsequently, after the homogenizer performed homogeneity processing under the pressure of 200kg/cm², sterilization processing was carried out for 30 minutes at 80 degrees C, and magnesium fortified milk was obtained (this invention article 1). Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added instead of the magnesium phosphate slurry, and the contrast article 1 and the contrast article 2 were obtained. The sedimentation nature of organic-functions evaluation and this invention article 1 by 12 persons' panelist was investigated with time using these. The result of organic-functions evaluation is shown in Table 1.

[0017]

[Table 1]

味の評価	本発明品	対照品 1	対照品 2
良い	5	0	0
やや良い	4	1	0
普通	3	3	2
やや悪い	0	3	4
悪い	0	5	6

[0018] As shown in Table 1, this invention article 1 was estimated to be tastier than the contrast article 1 and 2. Moreover, this invention article 1 did not produce sedimentation even for after 500-hour progress at all.

[0019] To 1.0kg of example fresh milk of manufacture of example 3. magnesium strengthening fermented milk, 10% magnesium phosphate slurry 100g of 20g of liquid sugars and an example 1 was added, and stirring was performed for 9000rpm and 20 minutes in TK homomixer. Subsequently, the homogenizer performed homogeneity processing under the pressure of 200kg/cm², after carrying out sterilization processing for 30 minutes and cooling to 40 degrees C at 80 degrees C, the lactic starter was added and it mixed with it, the container (the diameter of 5cm, height of 7cm) was filled up to height of 5cm, and it fermented at 38-40 degrees C, after becoming solid-like, it cooled, and yogurt (this invention article 2) was obtained. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 3 and the contrast article 4 were obtained. The dispersibility of the magnesium in the organic-functions evaluation and this invention article 2 by 12 persons' panelist was investigated using these. The difference in the magnesium concentration in yogurt estimated the dispersibility of magnesium. By not being concerned with the location which collected the sample, when the concentration was fixed, it was estimated that dispersibility was high. The measuring method of magnesium concentration was performed as follows. After writing the layer (0-1cm, 2-3cm, and 4-5cm) as a lower layer, a middle lamella, and the upper layer from the bottom of a restoration container, respectively and considering as homogeneity from the yogurt of this invention article 2, the wet ashing of the part was carried out, and the sample for atomic absorption spectrometry was obtained according to the conventional method. It measured on condition that the following using the atomic absorption spectro-photometer about these samples.

fuel gas; -- acetylene-air frame; -- acetylene 2.0L / part; -- air 14L / part
 measurement wavelength; -- in addition, 285.2nm of things for which a
 calibration curve turns into a straight line between 0-0.3microg [/ ml]
 magnesium concentration using the commercial magnesium standard solution

was checked. this invention article 2 was estimated to be tastier than a contrast article as a result of this invention article 2, the contrast article 3, and organic-functions evaluation of four. Moreover, the measurement result of the magnesium concentration of each class obtained from this invention article 2 is shown in Table 2.

[0020]

[Table 2]

	上層	中層	下層
本発明品 2 の各層にお けるマグネ シウム濃度	2 5 1 mg / 1 0 0 g	2 4 4 mg / 1 0 0 g	2 4 3 mg / 1 0 0 g

[0021] As shown in Table 2, the magnesium concentration of each class is almost fixed, and carrying out homogeneity distribution was checked.

[0022] 250g of example coconut hardened oil of manufacture of an example 4. coffee whitener, skimmilk powder 10g of constituents of 25g, casein sodium 25g, sorbitan monostearate (TAIYO KAGAKU [CO., LTD.] make: SunSoft No.61S) 2g, stearin acid monoglyceride (TAIYO KAGAKU [CO., LTD.] make: SunSoft No.8000) 2g, and an example 1 was added, the homomixer was used, 10,000rpm and emulsification for 2 minutes were performed, and the coffee whitener (this invention article 3) was prepared. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 5 and the contrast article 6 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 3 was estimated to be tastier than a contrast article as a result of this invention article 3, the contrast article 5, and organic-functions evaluation of six.

[0023] 700g [of example salad oil of manufacture of an example 5. dressing], 150g [of acetic acids], 20g [of salt], and xanthan gum 2g, guar gum 1g, lecithin 3g, 118g of water, and 1% of constituents obtained in the example 1 were added, the homomixer was used, 10,000rpm and emulsification for 2 minutes were performed, and the dressing (this invention article 4) was adjusted. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 7 and the contrast article 8 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 4 was estimated to be tastier than a contrast article as a result of this invention article 4, the contrast article 7, and organic-functions evaluation of eight.

[0024] 1% of constituents obtained in 888g [of example show oils of

manufacture of example 6. dripping], 100g [of salad oil], and xanthan gum 2g, and the example 1 -- adding -- a homomixer -- using it -- 10,000rpm and the emulsification for 2 minutes -- carrying out -- hanging down (this invention article 5) -- it prepared. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 9 and the contrast article 10 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 5 was estimated to be tastier than a contrast article as a result of this invention article 5, the contrast article 9, and organic-functions evaluation of ten.

[0025] 1% of constituents obtained in 250g [of example whipped cream of manufacture of an example 7. drink] and vodka 150g, 640g of water, 2g (HLB=11) of cane-sugar stearic acid ester, and the example 1 was added, the homomixer was used, 10,000rpm and emulsification for 2 minutes were performed, and the alcoholic beverage (this invention article 6) was prepared. The alcoholic concentration of an alcoholic beverage was 10% of fat 6%. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 11 and the contrast article 12 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 6 was estimated to be tastier than a contrast article as a result of this invention article 6, the contrast article 11, and organic-functions evaluation of 12.

[0026] 1% of constituents obtained in 80g [of example wheat flour of manufacture of example 8. white sauce] and butter 200g, 400g [of cow's milk], 370g [of water], 2g [of glycerol citric-acid stearic acid ester] (SunSoft No[by TAIYO KAGAKU CO., LTD.] .621B), and carrageenan 1g and the example 1 was added, the homomixer was used, 10,000rpm and heating during after [emulsification] 120-degree-C 10 minutes for 2 minutes were performed, and white sauce (this invention article 7) was prepared. The fat of white sauce was 17%. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 13 and the contrast article 14 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 7 was estimated to be tastier than a contrast article as a result of this invention article 7, the contrast article 13, and organic-functions evaluation of 14.

[0027] 1% of constituents obtained in 250g of example cocoa powder of manufacture of example 9. cocoa, 600g of sugar, 100g of lactoses, 40g of water, 3g (HLB=16) of cane-sugar stearic acid ester, and the example 1 was added, and it corned with the granulating machine. These 10g were calmly added to 40ml water, and it considered as the cocoa drink (this invention article 8). Similarly, the magnesium chloride water solution of the example 1 of

a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 15 and the contrast article 16 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 8 was estimated to be tastier than a contrast article as a result of this invention article 8, the contrast article 15, and organic-functions evaluation of 16.

[0028] While adding yeast food 25g and 400g of water to 700g of example glutinous wheat powder of manufacture of an example 10. pan and mixing enough by the mixer, a seed is prepared, and after carrying out inside kind fermentation, 300g [of glutinous wheat powder], 40g [of sugar], 20g [of salt], and shortening 50g, 20g of skim milk powder, 12g of constituents obtained in the example 1, and 280g of water are added, and it mixes enough by the mixer further. The ground was prepared. Then, according to the usual bread-making process, the pan was roasted and the magnesium strengthening pan (this invention article 9) was obtained. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 17 and the contrast article 18 were obtained. Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 9 was estimated to be tastier than a contrast article as a result of this invention article 9, the contrast article 17, and organic-functions evaluation of 18.

[0029] 800g of example whole eggs of manufacture of an example 11. processing whole egg, 50g of rapeseed oil, 150g of liquid sugars, and xanthan gum 1g%, 1% of constituents obtained in tamarind gum 1g and the example 1 was added, the homomixer was used, 10,000rpm and emulsification for 2 minutes were performed, the processing whole egg for cooking was prepared, it sterilized for 30 minutes at 70 degrees C, and the processing whole egg for cooking (this invention article 10) was obtained. Similarly, the magnesium chloride water solution of the example 1 of a comparison and the magnesium sulfate mixture solution of the example 2 of a comparison were added, and the contrast article 17 and the contrast article 18 were obtained.

Organic-functions evaluation by 12 persons' panelist was performed using these. this invention article 10 was estimated to be tastier than a contrast article as a result of this invention article 10, the contrast article 19, and organic-functions evaluation of 20.

[0030]

[Effect of the Invention] This invention can offer the magnesium fortified food which had after [little] food processing, such as heating, and was excellent in distributed stability, and bitterness is contribution-on industry size.

[Translation done.]